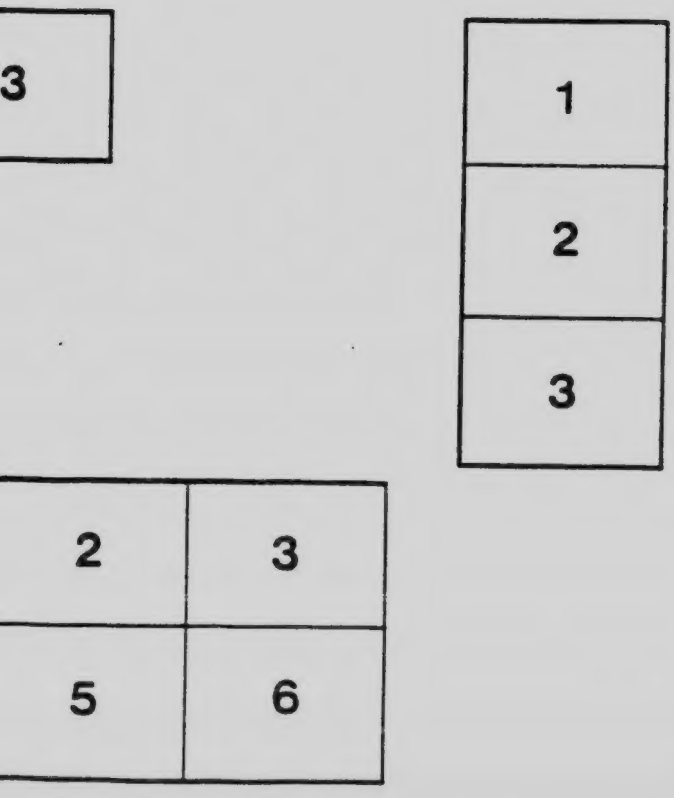

PUBLICA

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Dominion Astrophy

VICTO

Vol. I, N

THE ORBITS OF THE SPECTROSCO

BY S. L. BO

This star ($\alpha = 18^h\ 07{\cdot}5^m$, $\delta = +79^\circ\ 59'$ one of the first twelve binaries discovered at at Victoria, B.C., the announcement of which Astronomical Society of Canada" for Novemb

Dr. J. S. Plaskett secured five plates of t determinations, between June 19 and July 21, grams revealed the binary character of the st 18, 1919, 28 plates were secured. All of thes in 1918, were measured on the Hartmann Co From the measures of the first 14 or 15 of th measures of 1918 the period was found to b possible to get the remaining plates well di velocities did not, however, agree well with a the same phase showed as reasonable agreem plate number 2923 on the Hartmann Compa a closer examination of the plate revealed cl lines. A re-examination of all of the previo Plaskett in 1918, showed that on seven of these Since the lines of the two components are ju

LICATIONS

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ol. I, No. 20

ROSCOPIC COMPONENTS OF BOSS 4602

L. BOOTHROYD

79° 59′, photographic magnitude 6·6, type F5) is
ered at the Dominion Astrophysical Observatory
which appeared first in the "Journal of the Royal
ovember 1918.

tes of the star, in the programme of radial velocity
uly 21, 1918. His measures of these five spectro-
the star. Between July 1, 1919, and September
of these, as well as those secured by Dr. Plaskett
nn Comparator, using a sky or a Mars standard.
5 of the 1919 plates together with Dr. Plaskett's
d to be very close to 10·5 days. This made it
well distributed along the velocity curve. The
with any elliptic curve, although those at nearly
agreement as was to be expected. Measures of
Comparator proved an exception to this rule and
aled close companion lines to at least ten of the
previous plates, including those secured by Dr.
f these plates from four to ten lines showed double.
are just separable, for one-prism dispersion, and

besides this only those lines which are most intense show at all for the secondary component, it is easy to see why they were overlooked on the few plates on which from two to ten show at all. The table of observations lists only those plates which show double lines since these were the only plates used in the final determination of the orbits. The second column gives the initial of the person securing the spectrogram. All of the measures were made by the author except that the lines of the secondary component on plates 2484 and 2937 were also measured by Mr. Harper, the mean of his measures and the author's being used.

The writer had to leave Victoria on September 18, 1919, to resume his duties at the University of Washington and bad weather prevented securing more plates, at phases which would show the double lines, before October 15, and after that it was inadvisable to attempt to get any more plates in 1919, owing to the unfavourable position of the star for observation. However, in April 1920, Mr. Harper and Dr. Plaskett kindly secured three more plates at such phases as to show the lines double. Again in August 1920, four more plates were again secured at such phases as to show some of the lines double. Sixteen plates in all were therefore secured which show double lines and the orbit is based entirely on the measures of these sixteen plates. The remaining twenty-six plates were measured on either the Hartmann Comparator or the Gaertner measuring machine or on both, but none of these measures were used in the final computations for the orbital elements.

The lines of the secondary component are quite faint whereas those of the principal component are rather diffuse and much more numerous. The probable error of a plate for the principal component is $\pm 2{\cdot}36$ and for the secondary $\pm 4{\cdot}65$ km. per second. The mass of the secondary component is $0{\cdot}903$ times that of the principal component.

In the following table of observations the phases are reckoned from the final value of periastron passage using the corrected period $10{\cdot}5217$ days.

OBSERVATIONS OF BOSS 4602

Plate Number	Observer	Date	Julian Date	Phase	Component 1			Component 2		
					Vel.	Lines	O-C	Vel.	Lines	O-C
		1918								
217	P	June 22.....	2,421,767·804	3·1559	+38·3	6	+0·4	−34·7	6	+ 1·4
		1919								
2238	P	July 1.....	2,141·798	8·8904	−43·9	9	+1·4	+61·9	9	+ 5·2
2484	B	" 22.....	2,162·729	8·7780	−42·3	9	+1·7	+65·2	8	+ 9·9
2510	Y	" 23.....	2,163·769	9·8180	−41·7	6	−1·6	+58·0	4	+ 7·1
2595	Y	Aug. 6.....	2,177·716	2·7216	+47·0	4	+5·0	−40·9	5	− 0·2
2714	H	" 15.....	2,186·790	1·2739	+42·7	2	+2·0	−39·9	2	− 0·7
2798	Y	" 22.....	2,193·671	8·4549	−37·2	7	−1·2	+45·2	5	− 1·1
2923	H	Sept. 12.....	2,214·641	8·0815	−39·4	10	−4·6	+39·6	9	− 5·4
2937	Y	" 13.....	2,215·634	9·0745	−44·6	5	+1·6	+57·1	6	− 0·7
		1920								
4057	H	April 9.....	2,424·993	7·9995	−33·7	6	−0·2	+41·4	5	− 2·2
4148	H	" 23.....	2,438·952	0·9151	+31·1	7	−1·0	−33·8	7	− 4·2
4190	H	" 30.....	2,445·958	7·9211	−37·2	5	−4·9	+32·1	3	−10·1
4790	P	Aug. 5.....	2,542·749	10·0161	−31·8	7	+2·4	+51·5	7	+10·1
4802	P	" 7.....	2,544·679	1·4251	+40·6	6	−2·3	−43·9	4	−22·2
4814	Y	" 8.....	2,545·704	2·4501	+42·2	10	−1·9	−42·8	11	+ 0·2
4826	B	" 9.....	2,546·696	3·4421	+39·2	4	+4·4	−21·3	5	+11·3

From the preliminary elements, given later, observation equations were built up according to the notation of Lehman-Filhés, modified to suit the case of double spectra,* and a least squares solution effected. Since the observations extended over parts of three seasons, the period was also included in the solution. This necessitated treating all the observations separately.

By making the following transformation a set of 32 observation equations involving the seven unknowns γ, K_1, K_2, e, ω, P, and T were built up. The weights are given in the last column.

$$x = \delta\gamma$$
$$y = \delta K_1$$
$$z = \delta K_2$$
$$t = 50\ \delta e$$
$$u = [2{\cdot}81500]\ \delta P$$
$$v = 50\ \delta\omega$$
$$w = [1{\cdot}53628]\ \delta T$$

*Dominion Observatory Publications, Vol. 1, page 327.

OBSERVATION EQUATIONS FOR BOSS 4602

1	1·000x	+0·677y	0·000z	−0·915t	+0·811u	−0·410v	+0·420w	−4·600	=0	4
2	1·000	−0·996	0·000	+0·170	+0·005	+0·203	+0·075	−1·000		5
3	1·000	−0·987	0·000	+0·321	−0·006	+0·130	+0·137	−2·200		5
4	1·000	−0·796	0·000	−1·085	+0·038	+0·851	−0·794	+6·200		4
5	1·000	+0·859	0·000	−0·838	−0·041	−0·199	+0·344	−4·800		2
6	1·000	+0·920	0·000	+0·790	+0·075	+0·650	−0·461	+2·400		3
7	1·000	−0·869	0·000	+0·822	−0·067	−0·184	+0·337	−1·800		4
8	1·000	−0·848	0·000	+0·854	−0·107	−0·216	+0·352	+1·400		5
9	1·000	−1·000	0·000	−0·033	+0·005	+0·297	−0·015	−0·500		4
10	1·000	−0·798	0·000	+0·904	−0·515	−0·285	+0·381	−1·900		4
11	1·000	+0·649	0·000	+1·136	+1·535	+0·996	−1·078	+1·300		4
12	1·000	−0·773	0·000	+0·917	−0·572	−0·315	+0·391	+2·800		4
13	1·000	−0·793	0·000	−1·089	+1·556	+0·854	−0·801	−3·600		4
14	1·000	+0·909	0·000	+0·831	+0·967	+0·673	−0·495	+4·000		4
15	1·000	+0·956	0·000	−0·552	−0·448	+0·008	+0·228	+4·600		5
16	1·000	+0·708	0·000	−0·923	−0·809	−0·382	+0·412	−4·000		3
17	1·000	0·000	−0·677	+0·974	−0·862	+0·436	−0·447	+2·700		2
18	1·000	0·000	+0·996	−0·181	−0·005	−0·216	−0·080	−10·200		1
19	1·000	0·000	+0·987	−0·342	+0·006	−0·138	−0·146	−14·000		1
20	1·000	0·000	+0·796	+1·155	−0·041	−0·905	+0·845	−16·300		1
21	1·000	0·000	−0·859	+0·892	+0·043	+0·212	−0·366	−0·200		2
22	1·000	0·000	−0·920	−0·840	−0·080	−0·692	+0·490	−4·200		1
23	1·000	0·000	+0·869	−0·875	+0·071	+0·196	−0·359	+0·100		2
24	1·000	0·000	+0·848	−0·909	+0·113	+0·230	−0·375	+4·700		2
25	1·000	0·000	+1·000	+0·035	−0·005	−0·316	+0·016	−5·200		1
26	1·000	0·000	+0·798	−0·962	+0·055	+0·303	−0·405	+0·400		2
27	1·000	0·000	−0·649	−1·209	−1·633	−1·060	+1·147	+3·200		2
28	1·000	0·000	+0·773	−0·976	+0·608	+0·335	−0·416	+8·400		1
29	1·000	0·000	+0·793	+1·159	−1·656	−0·909	+0·852	−13·000		1
30	1·000	0·000	−0·909	−0·884	−1·029	−0·716	+0·527	+0·300		2
31	1·000	0·000	−0·956	+0·587	+0·476	−0·008	−0·243	−3·100		2
32	1·000	0·000	−0·708	+0·982	+0·860	+0·406	−0·438	−12·200		1

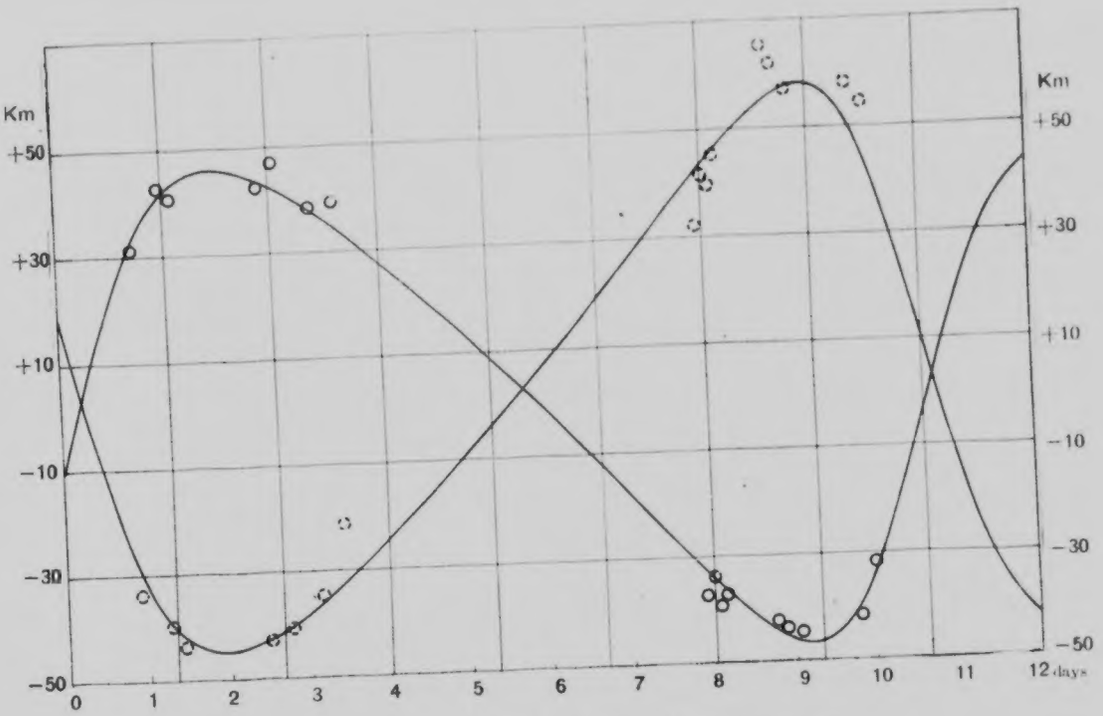
NORMAL EQUATIONS

22·000x	− 3·487y	+0·162z	+ 1·017t	+ 1·033u	+1·925v	−0·510w	−10·825=0
	+11·837	+0·000	− 1·988	+ 1·249	−0·056	−0·797	+ 6·143
		+4·276	− 1·180	+ 0·784	+0·363	−0·494	− 6·692
			+15·220	+ 0·500	+0·675	−0·177	− 6·146
				+11·051	+5·458	−5·625	− 3·955
					+5·613	−5·279	+17·423
						+5·590	−13·837

The solution of these equations gave corrections to the preliminary elements, as given in the following table. One solution was deemed to be all that was warranted from the data at hand, as judged by the fair agreement of the final ephemeris residuals with those obtained by substitution in the observation equations. The sum of the squares of the residuals for the observed places was reduced from 1757 to 1082, or about 38 per cent.

TABLE OF ELEMENTS

Element		Preliminary	Final
Period	P	10·527 days	10·5217 ±0·0018 days
Eccentricity	e	0·30	0·314 ±0·014
Longitude of apse	ω_1	270°	256°·76 ±4°·38
Longitude of apse	ω_2	90°	76°·76 ±4°·38
Velocity of system	γ	+1·88 km. per sec.	+2·93 ±0·62 km. per sec.
Semi-amplitude primary	K_1	47 km.	46·16 ±0·83 km.
Semi-amplitude secondary	K_2	50 km.	51·50 ±1·32 km.
Periastron passage	T	J.D. 2,421,764·592	J.D. 2,421,764·6481 ±0·1112
Semi-major axis	$a_1 \sin i$		6,341,000 km.
Semi-major axis	$a_2 \sin i$		7,074,000 km.
Mass primary	$m_1 \sin^3 i$		0·457 ⊙
Mass secondary	$m_2 \sin^3 i$		0·413 ⊙



Radial Velocity Curves of Boss 4602 Showing Individual Observations.

The graph shown represents the velocit
observations are plotted. An interesting
re-determine these orbits from plates obtain

I wish here to express my appreciatio
and all the members of his staff at the Do
during my stay at the Observatory for twel
of the summer of 1920. Every possible fa
in the prosecution of the work on Boss 4602
I am working, the results of which work wil

University of Washington,
Seattle, Wash.
October 1 1920.

velocity curves using the final elements. Individual
sting problem, reserved for the future, will be to
obtained with higher dispersion.

eciation of the kindness shown me by Dr. Plaskett
he Dominion Astrophysical Observatory at Victoria
r twelve weeks of the summer of 1919 and six weeks
ble facility and assistance were extended to aid me
s 4602 and on other spectroscopic binaries on which
rk will appear as soon as completed.